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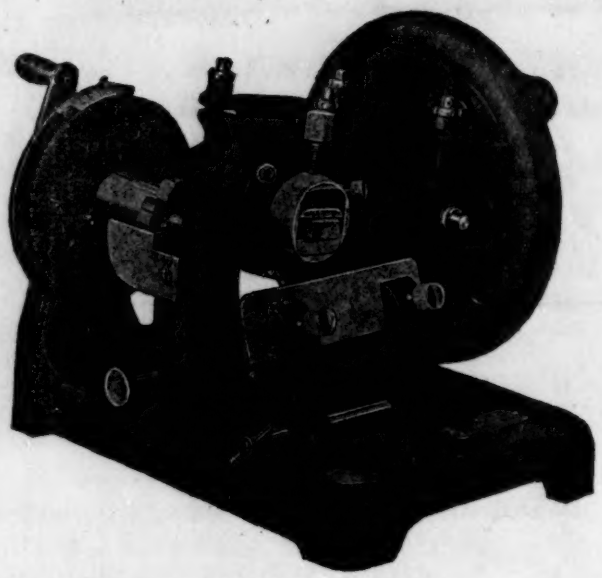

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THE SIGNIFICANCE OF THE DECLINING BIRTH RATE[1]

IT is a custom of this Section, I believe, for the retiring vice-president to select for his address a subject of national interest in the field of social economy. He is expected to avoid narrow and technical discussion of specialties but he may properly summarize the important works of other investigators in specialized fields to show their trend and bearing and he may also point out the direction which further research should take. These requirements of the occasion are all the more necessary now in view of the circumstances under which we are living. We are going through a period of serious conflict. Our nation is at present engaged in concentrating its resources of men, of materials and, above all, of thought, to make itself felt in the world struggle for preserving civilization. This is no time for trivialities or for small detail. Under these conditions, the Section on Social and Economic Science of the American Association may be expected to have a message of national import. It would be inexcusable to take your time and attention for anything but a topic of the widest practical significance in the present national emergency.

With these considerations in mind, I have chosen as the subject of this address the significance of our declining birth rate. I have done so with considerable hesitancy because of the difficulty of the subject and the importance of its present lesson. I

[1] Address of the retiring vice-president and chairman of Section I, Social and Economic Science, American Association for Advancement of Science, Pittsburgh, December 29, 1917.

shall count also on your forbearance, hoping that you will forgive the incompleteness and sketchy character of my argument. The study of American demography has convinced me that we are concerned with a problem of the greatest possible moment. Changes have been progressing in the internal structure of our population which have, for the most part, escaped attention and which, if allowed to continue, will result in very serious national embarrassment. Conditions of war bring into relief the necessity for a vigorous and efficient population. It is not too much to say that the present tendencies in our national and family life are such as seriously threaten the development of those groups in the population on which we must rely for vigor and efficiency in thought and action.

The declining birth rate has received but little scientific attention in the United States. It has been, however, the subject of very careful investigation in Europe. During the last fifty years, the birth rate has declined in virtually every country of the civilized world. Some countries have been affected more than others, but the phenomenon has been observed in extreme form in one country, namely, France. France has made an experiment in birth control on a national scale. All the parts of that experiment, including the end result, are now on view and available for scientific observation and comment. Before the present war, France had already reached a point where her birth rate had decreased to a point below her death rate; her population was actually decreasing. But for ten years before that time, the approaching crisis had called for the careful attention of her best minds.

A commission on depopulation composed of statesmen and sociologists was appointed to study the problem and a series of comprehensive reports[2] on the sources of depopulation have been prepared. These reports are too elaborate for detailed description here. I shall rather present the situation for France, as I understand it, in broad outline, bringing into relief only the main findings of the commission.

Let us consider the growth of population during the last century in the three leading countries of western Europe, namely, France, the United Kingdom and the states composing the German Empire.[3] At the beginning of the nineteenth century France was the leader of the three countries, with a population of about twenty-nine million. The states which now compose the German Empire were second, with a population of about twenty-three million, and the United Kingdom stood third with a population of about eighteen million. A century later, we find the situation totally changed. The German Empire headed the list with a population of nearly sixty-five million, the United Kingdom was second with a population of forty-five million and France was third with a population of only thirty-nine million. In other words, while the population of the German Empire had nearly trebled and the United Kingdom had increased to two and one half times its earlier numbers, the population of France had increased less than one half. Further inspection of the figures shows that a marked change in the rate of increase of the population of France occurred about the year 1860. At that time France was still in the lead and had already reached a population of thirty-seven million. After that date it

[2] A series of reports on the death rate by Bertillon, Löwenthal, Drouineau, Atthalin, Fevrier, and Strauss; and on the birth rate by Neymarck, March, Bertillon, Rey, Drouineau, Atthalin and Lyon-Caen. Melun, Imprimerie Administrative, Paris.

[3] Burn, Joseph, "Vital Statistics Explained," London, 1914, page 19.

increased only two million, while Germany in the same period almost doubled in population. In 1811, the population of France constituted 16 per cent. of all Europe. One hundred years later the French population constituted only 9 per cent. of the total.

This situation for France may be accounted for principally in terms of its declining birth rate. Such figures as I have for France show that at about 1830 the rate was 30 births per 1,000 of population.[4] The last available figure for 1914 was 18 per 1,000; the death rate was 19.6 per 1,000.[5] This was the first war year, but already in 1911 the death rate, 19.6, exceeded the birth rate, 18.7. The reduction of more than one third in the birth rate during the eighty years was both gradual and continuous. On the other hand, the birth rates in the German Empire and in the United Kingdom continued high, over 30 per 1,000 up to 1895 in the latter and up to 1909 in the former. Since then the birth rates have declined rapidly in both countries, but the enormous increases in population for both Germany and the United Kingdom were achieved before the changes in the birth rate began to make themselves seriously felt.

We are not concerned entirely with gross totals of population. Equally significant is the internal structure of population. As we shall see later, changes in the constitution of a population almost invariably appear with changes in the birth rate. This will become clearer by comparing the ages below which, one quarter, one half and three quarters of the total populations of Germany, of England and Wales and of France, respectively, are found.[6] Thus, one quarter of the population of Germany is under age eleven, one quarter of the population of England and Wales is under twelve years of age, whereas one quarter of the French population is under fourteen years. Again, one half of the population of Germany is found under 23.5 years, one half of the population of England and Wales is below twenty-six years while one half of the French population is below age thirty. We find, finally, that three quarters of the population of Germany is below age forty-one years, of England and Wales is below forty-two years and of France is below forty-nine years. These figures show clearly that the average age of the French population is considerably higher than that of the other two countries. Its youth and its strength form a smaller part of its total population, while its old and its dependents form a much larger part. This we shall find is an invariable consequence of a decreasing birth rate, which reduces the proportion of the young and thus brings into relief an undue proportion of the aged.

The declining national birth rate of France is also severely selective in character. The reduction of the birth rate has affected mostly those who are both economically and socially best fitted to bear and to raise a family to maturity. A careful classification by Bertillon[7] of the number of children per 100 families in Paris, shows that the very poor have the largest number and the very rich the smallest number of children. The order of size of the family is invariably the reverse of the order of economic condition. Since economic status

[4] "Ministere du Travail et de la Prevoyance Sociale," *Statistique Internationale du Mouvement de le Population jusqu'en 1905*, Vol. 1, 1907.

[5] Annual Report of the Registrar-General of Births, Deaths and Marriages in England and Wales, 1915, p. 71.

[6] Burn, Joseph, *op. cit.*, p. 30.

[7] Bertillon, Jacques, "Nombre d'Enfants par Familles," *Journal de la Société de Statistique de Paris*, April, 1901, p. 134.

is highly associated with efficiency and social worth, low birth rates in the best equipped groups of the population can have but one effect on the vital constitution of the next generation—namely a decline in constructive effort for national development.

Evidence suggestive of such decline in national development is afforded by the fact that coincident with a rapidly declining birth rate, France has had a high and rather stationary death rate during the last quarter of a century. England, through the development of its public health service, reduced its death rate to under 14 per 1,000 in the year before the war (1913) when France had a death rate four per 1,000 higher. In spite of the low French birth rate, the infant mortality rate has not been low, and has been coupled with a high still birth rate. The death rate from tuberculosis in France has recently come into public notice here because of war conditions, but it was high before the war. The acute infectious diseases, including typhoid fever, which have so readily lent themselves to control in other European countries and in the United States, show unsatisfactory death rates for France. In fact, we find in this country, side by side with a low rate of reproduction, evidence of indifference to the conservation of the valuable lives that are born. A disturbing element in the French situation to-day is the lack of a national public health program. Is it not possible that such conditions result directly from the absence in the community of those earnest and able men who everywhere further progress along social and economic lines? These leaders of the nation are absent because they were not born.

It is painful to say these things at this time and I should refrain from referring to them were it not for the necessity of emphasizing the facts which so directly affect our own American population problems.

The experience of England has been much less acute, although the tendency of the most recent years has been as disturbing as that in France during the previous decade. In the five-year period between 1871 and 1875, the birth rate was 35.5 per 1,000 of population.[8] In the period 1911 to 1914, inclusive, the birth rate was only 24 per 1,000. The reduction in the birth rate in England has been accompanied, to be sure, with a very healthy decline in the death rate. In the forty-odd years since 1871 this has decreased from 22 to less than 14 per 1,000; whereas the decreasing birth rate in France did not accompany any appreciable reduction in the death rate. The rate of natural increase has, however, declined in England from 13.5 in the period 1871–1875 to 10.1 per 1,000 in the period 1911–1914. England was still increasing in population at the rate of 1 per cent. annually before the war. The reduction in the rate of natural increase and certain internal changes in structure of population had, however, become a source of apprehension to English statesmen and a commission of qualified experts was appointed to study and report on the problem. Their findings[9] have been available for some time and may be summarized as follows:

The birth rate has declined to the extent of approximately one third during the last thirty-five years.

This decline has not been due to any large extent to a decline in the marriage rate or to a rise in the mean age at mar-

[8] Baines, Sir J. Athelstane, "The Recent Trend of Population in England and Wales," *Journal of the Royal Statistical Society*, London, July, 1916, p. 399.

[9] National Birth Rate Commission, "The Declining Birth Rate—Its Causes and Effects," London, 1916.

riage or to other causes diminishing the proportion of married women of fertile age in the population. The decline has been due rather to a conscious limitation of fertility in the large mass of the population.

The decline in the birth rate, although general, has not been uniformly distributed over all sections of the community. It has affected primarily those economic and social groups which, as we have shown for France, are best able to bear and maintain a good-sized family. Thus, we find that the number of legitimate births per 1,000 married males under 55 years in England and Wales was 119 for the upper and middle classes and 213 for the unskilled workmen, with a maximum of 230 among the miners.[10] The birth rate is greater as the economic and social status is lower.

Internal changes of population are taking place in England very similar to those observed in France. Under the influence of the decreasing birth rate the average age of the population of England and Wales is rising and the proportion of old persons is, of course, correspondingly increasing. If we keep in mind also that the mortality rates of females at the adult ages are progressively lower than those for males we are not surprised to find that the increasing proportion of old people is greater among females than among males. While there were, for example, 119 females per 100 males in 1871 at the ages sixty-five and over, the number in 1911 had become 132. The disturbing element in this picture is that the population is growing older not only through the increased longevity of its constituents but more especially through the decreasing reenforcement from its youth and, due to the operation of mortality, that there is a progressive excess of females over males at the older ages. The situation in England may be summed up in the words of her leading demographer, Sir J. Athelstane Baines, as follows:

> In the last forty years, the proportion of people of an age to marry has materially increased, but they marry less and later in life, and thus, to some extent, cause a reduction in the number of births. The main cause of the falling birth rate, however, is the decline in the fertility of the married, due to the voluntary restriction of childbearing, a decline which has been especially rapid since the beginning of the century. The effects of the fall in the birth rate have been neutralized, until within the last few years, by a still greater fall in the death rate. The improvement has not been so marked among the very young and the old as at adolescence and in the prime of life. While, therefore, the rate of natural increase has diminished less than the fall in the birth rate would indicate, it has been maintained at the expense of the young.
>
> As the proportion of infants with a high mortality decreased that of the ages of low mortality increased. The death rate went down, and the balance of population became economically favorable. But as the supply of infants diminishes relatively to the rest of the community, and their elders pass from their prime into the time of life when mortality is heavy, the proportionate supply of potential parents of the most prolific ages tends to decrease, the birth rate falls more rapidly, and the death rate begins to rise, leaving the margin of natural increase alarmingly narrow. The result is an older and less vigorous people; and as the vitality of women is greater than that of men, more of the former sex reach maturity, and they last longer, so that a relatively small and probably wholesome numerical superiority at the working ages is converted into a growing preponderance of old women in the vale of life.[11]

I shall now present the situation for the United States. Superficially, the facts of American population growth present a very favorable picture. Each successive census has shown a marked increase in our total population over the preceding one; that for 1910 showed an increase of nearly 16 million lives over 1900, or 21 per cent.

[10] Annual Report of the Registrar-General of Births, Deaths and Marriages in England and Wales, 1912, p. xxiii.

[11] Baines, Sir J. Athelstane, *op. cit.*, p. 413.

Such data as we have for births and deaths indicate a similar situation. Our birth rate is probably about 25 per 1,000 and the death rate for the entire country not far from 15 per 1,000. The difference between the birth rate and the death rate, the rate of natural increase, is about 10 per 1,000 or 1 per cent. annually. The rate is much the same as we found for England and Wales in the year before the war. No one should find fault with a rate of natural increase of 1 per cent. per year. The population problem of France would be considered on a fair way to solution if that country could maintain for a period of years a rate corresponding to even one half of that which we now enjoy in the United States.

The difficulty with our American situation is that we have been satisfied with a gross showing. We have not looked underneath the surface to observe the varying tendency in the several groups of the population and in the several sections of the country. The marked increase in our total population is in large measure the result of two factors: (1) immigration and (2) a high rate of increase in the foreign born rather than in our native stock. This is shown by the constantly decreasing proportion which the native whites of native parentage form of the total white population[12] In 1870, for example, this group formed 67.8 per cent. of the total white population in the United States, while in 1910 it had decreased to 60.5 per cent. The proportion of the foreign stock correspondingly increased during these forty years. These figures are accentuated if we turn to certain areas of the country. Thus, in the New England states the proportion of the native white stock decreased from 52.3 per cent. of the total white population in 1890 to 40.3 per cent. in 1910. In the Middle Atlantic states the native white stock decreased from 51.8 in 1890 to 44.8 in 1910. In these important areas the native stock is playing an ever smaller part in the composition of the total population. In fact a very definite tendency toward depopulation has already fastened itself upon a large part of the native stock of the country.

There has been a marked and continuous reduction in the birth rate in the United States for a period of years. In the absence of comprehensive birth statistics such as are available for European countries, we must turn to other sources which are clearly indicative of the changes which have occurred in the birth rate. We may use, for example, the number of children under 5, per thousand women in the childbearing ages, namely, fifteen to forty-four years inclusive. Professor Willcox in a recent paper has shown that this proportion has decreased about 50 per cent. in the course of the last hundred years. At the beginning of the century there were 976 children under five for every 1,000 women between the ages of fifteen to forty-four years, whereas in 1910 the number was only 508 per thousand women at these ages. During the 60 years between 1850 and 1910 the number of children under five, per thousand women at the childbearing ages, decreased in the United States by 191 or at an average of 32 in each decade. The rate of decline in the recent decades has been so rapid that Professor Willcox[13] suggests amusedly that if it were continued over a period of a century and a half, which is a comparatively short time in the life of a nation, there would be no children at all at the end of that time.

[12] Thirteenth Census of the United States, Vol. 1, Population: General Report and Analysis.

[13] Willcox, Walter F., "Nature and Significance of the Changes in the Birth and Death Rates in Recent Years," Quarterly Publications, American Statistical Association, Boston, March, 1916, p. 1.

The decline in the birth rate in the United States has been, as elsewhere, selective in character. In Massachusetts, for example, where the best American data on birth rates are available, we find first that there has been a continuous decrease in the birth rate during the last 40 years and second, that this decrease has been most marked in the native stock. In 1910 the native stock had a birth rate of 14.9 per thousand; the foreign born birth rate was 49.1 per thousand.[14] In the same year the native death rate was 16.3 per thousand, while the foreign death rate was only 15.4.[15] There was thus an excess of deaths over births corresponding to a net annual loss of a little more than one tenth of 1 per cent. in the native stock while there was an annual increase of 3.4 per cent. among the foreign born population.

A tabulation of a significant sample of the population returns for the 1910 census shows similar differences in the fecundity of women of native and foreign parentage.[16] In a group of women under forty-five years of age, who were married for a period of from ten to twenty years, the average number of children was found to be 4.1 per married woman. The women of native parentage, however, showed an average of only 2.7 children whereas the women of foreign parentage showed an average of 4.4 per married woman. In like manner, it was found that 7.4 per cent. of the women under forty-five years, who had been married ten to twenty years, had borne no children. The women of native parentage had borne no children in 13 per cent. of the cases, whereas, the women of foreign parentage had borne no children in only 5.7 per cent. of the cases. In view of the fact that very few children are born to women who have been unproductive for a period of at least ten years, we may consider these figures as fairly reliable indices of sterility in the two groups. We find that close to 40 per cent. of the married women of native parentage had borne only one or two children, whereas the women of foreign parentage showed only 19 per cent. of their number in this group. Finally, only about 10 per cent. of the women of native parentage had five children or more whereas 33 per cent. of the women of foreign parentage belong in this group.

I hope I am not assuming too much when I infer that these figures show selection in the decline of the birth rate. The race stock which laid the foundations of our institutions during the critical period of our national existence is in large areas of the country no longer maintaining itself and its place is being taken gradually but surely by foreign races, which, as we have seen, are reproducing very rapidly.

Additional evidence of the selective character of the declining birth rate is presented in special studies on the size of families of college graduates and of men of science. Thus, Phillips[17] in his work on the birth rate among graduates of Harvard and Yale universities shows that the number of children born per married graduate has fallen from about 3.25 in the decade 1850 to 1860, to a little over 2 in the decade 1881 to 1890. Similar facts are observed in the statistics for other college graduates; but none are so low as those for the graduates of colleges for women. Thus,

[14] Commonwealth of Massachusetts, Annual Report on Births, Marriages and Deaths, 1914, p. 181.

[15] Mortality Statistics, 1910, United States Bureau of the Census.

[16] Hill, Joseph A., "Comparative Fecundity of Women of Native and Foreign Parentage in the United States," Quarterly Publications, American Statistical Association, Boston, December, 1913, p. 583.

[17] Phillips, John C., "A Study of the Birth Rate in Harvard and Yale Graduates," *Harvard Graduates Magazine*, Boston, September, 1916, p. 25.

we find that the number of children per married woman graduate of Smith College was only 1.3, of Vassar, 1.6, of Bryn Mawr, 1.7 and of Holyoke, 1.8. Even more significant is the ratio of children per graduate, which, for all of these colleges, is less than one, due to the fact that less than 50 per cent. of the graduates of women's colleges marry.[18] Professor Cattell[19] further shows in his study of 643 American men of science that the families from which the scientific men had come had an average of 4.7 children, while these scientific men who were married and whose families were completed had an average of only 2.3 children, these figures including all the children born. We shall later see how far from adequate such an average number of children is for maintaining the *status quo* in the respective groups.

In the preceding discussion I have referred frequently to the number of children per family in groups of our population and have intimated that some families were small, that others were fairly normal and that others were large. You may now properly ask me what the average number of children per family should be. The answer to the question depends upon the point of view, namely, upon the amount of natural increase one would wish to see in a generation. As there is likely to be a difference of opinion on this point, I shall attempt to show only what the number of children in a family must be, under present conditions, in order that the population may remain stationary; anything above this figure will mean natural increase, anything below will mean a decrease in population.

[18] Nearing, Nellie Seeds, "Education and Fecundity," Quarterly Publications, American Statistical Association, Boston, June, 1914, p. 126.

[19] Cattell, J. McKeen, "Families of American Men of Science," *Scientific Monthly*, March, 1917, p. 248.

It is obvious that the basis of every family is two individuals. The question then resolves itself as follows: How many children must be born to every family in order that two individuals may be raised to maturity? The number of children born must be more than two for a number of reasons. The first is the fact of mortality. The death rate is exceptionally high in the period of childhood, amounting in the first year of life to about 10 per cent. of the babies born. If we begin with 100,000 at birth and trace them through from year to year, we find that about 78,000 are alive at the average age at marriage. This is according to the mortality rate that prevails over a large portion of the United States. The rest have died. This fact alone would make it necessary that every marriage result in an average of $2\frac{1}{2}$ children in order that two persons may attain the average age of marriage and replace their parents in the population. But this assumes first that all persons marry, and second, that every marriage is productive. As a matter of fact all persons do not marry. In our own country from 12 to 15 per cent. do not marry until after the reproductive period, if at all. A considerable proportion of marriages, over 7 per cent., are sterile. When we make the necessary corrections in our figures, the average number of children per family which must be born is increased to close to four[20] in order that the stock may maintain itself without increase or decrease.

I say without hesitation that a large part of the native stock of this country is in this sense not maintaining itself. It is not producing the four children that are necessary to perpetuate the stock. This fact is true primarily for those families in

[20] Sprague, Robert J., "Education and Race Suicide," *Journal of Heredity*, Washington, D. C., April, 1915, p. 158.

the population which, by economic and social standards, are best able to bear and rear 'children' families. On the other hand, those groups in our population which are economically and socially less able to raise families are still producing, on the average, in excess of the minimum necessary to maintain the *status quo*. As a result, the balance of population is in favor of the less economically efficient. The best blood of America is being constantly thinned out by the exercise of a conscious limitation of births and is being replaced by a stock of a different order. Our national standards are being levelled to meet more and more the lower quality of our population.

If I have succeeded in making a plausible diagnosis of one of our national ills, will you permit me, also, to suggest a remedy for the condition? I should say, at the outset, that since many causes have been at work to produce the end result which I have described, it will require many lines of action to improve the situation. I shall, however, suggest some thoughts which seem to me to reach the heart of the problem more nearly than any others.

The state is largely responsible for the present condition. The system of education which it has provided for the youth of the country has failed for the most part to inculcate national ideals. Our young people have grown up without a broad outlook on life. They have been taught to think in terms of personal convenience and advancement and not in terms of the common good. Democratic education is a failure if it neglects to make provision for the character of its future citizenship. Our young men and women must be taught to realize early that we do not live for ourselves; that our intellectual, economic and social advancement must be carried forward not only as tradition but more especially in terms of new vigorous and worthy personalities. Our educational system must make our various racial groups conscious of their best traditions and instil desires to see their better strains strengthened and increased as a foundation of the greater democracy of the future.

The education of our women is especially faulty in this regard. Our schools and colleges, with few exceptions, direct the thoughts and energies of our girls away from ideals of normal home life and center them upon personal refinement or upon personal ambition. It is no uncommon thing to find that girls have gone through their entire college course without a single occasion when the subject of their place in society as mothers and wives was given serious consideration. No wonder that our educated women think mainly of careers or of pleasures offered by society as the aim of existence. These are all false gods which smother the natural and wholesome instincts which every species possesses to insure its maintenance. The old virtues of womanhood need restatement to-day. Whatever else women learn in the schools, they must be educated for their place as mothers, and democratic education must make efficient provision for this primary function.

The state is guilty of another sin. It has made no provision to reward, either substantially or with esteem, the women who, realizing their obligation to the state, are willing to bring up families of normal size. The bearing and rearing of children is costly, both in energy and in funds, and must act as a check on personal ambition and on the enjoyment of the freedom and pleasures of social life. A family of four children will require the attention of the capable woman for many years. Her success as a mother will be at the expense, in the majority of cases, of her achievement in other fields. It is not asking too much

that such a woman should be favored with the admiration of the community in which she lives and not as at present with its commiseration and pity. The state may find it expedient, likewise, to encourage parenthood by considering the size of the family as a factor among others in fixing exemptions from taxes.

Individual selfishness is at bottom the source of the evil I have described. An increasing number of men and women do not assume the marital state or, when married, do not raise a family of children, because they prefer to live better than their forebears and to spend more on themselves than would be possible if they had children to raise and educate. Under present conditions children are not an economic asset. Restrictive compulsory education and child-labor laws make children an expensive luxury which only the poor can afford. In fact, there is no very good reason on the score of personal comfort alone why individuals should assume the obligations and sacrifices which large families entail. Such, indeed, is the logical conclusion of our growing materialism. Yet the shallowness of this attitude must be obvious. Men and women who to-day are rallying to the defense of the country in war time, need not be reminded that we live not for ourselves but rather for the fuller life of the community. If only the same spirit would animate us in times of peace! More would then meet their obligation to the state through parenthood. A new citizenship would then arise which would be worthy to receive the noble traditions from our past and to carry our civilization forward into the future. Our appeal must be made to the religious impulse in our individual lives. It will require all the religious power latent in our people to set us right. I do not mean the mandate of any particular religious sect but rather the ethical force which arises within us when we realize clearly our relation to the community about us and the obligation which this relationship involves. The problem of the size of the family, like a whole host of other important social questions, will be solved only when men realize the holy purpose of life, that we are here to add to the sum total of the common good, in a word, that we must leave the world better than we have found it.

In conclusion, let me emphasize the need for birth release among the healthy and normal people of our country as a primary national duty. Such release must be conscious and deliberate, the act of will of free individuals who thus express a highly moral purpose.

Louis I. Dublin
Metropolitan Life Insurance Company

MINUTES OF THE WAR EMERGENCY BOARD OF AMERICAN PLANT PATHOLOGISTS

A special meeting of the War Emergency Board was held in Washington, D. C., February 9, 10 and 11, 1918. The following commissioners were present: Professor H. H. Whetzel, chairman, of Cornell University; Dr. F. D. Kern, of the Pennsylvania State College; Dr. E. C. Stakman, of the University of Minnesota; Professor H. P. Barss, of Oregon State Agricultural College; Professor H. W. Barre, of Clemson College, S. C., and Dr. G. R. Lyman, of the Bureau of Plant Industry.

Dr. Mel T. Cook, of the New Jersey Agricultural Experiment Station, and Professor H. S. Fawcett, of the Citrus Experiment Station, Riverside, Calif., also took part in the deliberations of the board, and many of the federal pathologists were called in consultation. Open meetings were also held at which practically all the pathological workers of the Department of Agriculture were present, for discussion of the program of war emergency work.

All the commissioners reported practically universal approval of the aims and objects of

the War Emergency Board on the part of the pathologists and administrative officials directing the agricultural work of their respective districts. Hence the board is assured of active and enthusiastic support on all sides. The board will find its most important work in capitalizing and translating into action the spirit of cooperation which has been stimulated and developed by the national emergency caused by the war.

The board noted with approval the definite program of cooperation both in extension and research work adopted by the pathologists of the Southern Section in the conference held at Atlanta, Ga., January 30 and 31, which must greatly increase the efficiency of the pathological work undertaken in that section this season. It was decided that similar conferences should be called during February and March by the commissioners of the other five sections of the country, thus giving the pathological workers of each district an opportunity to discuss their common problems and decide upon definite plans for cooperative action.

Commissioner Kern reported on the progress of the census of pathologists being carried on under his direction. Enrollment questionnaires were sent out to pathologists and botanists some time ago, and all were urged to send in the names of others to whom the enrollment cards should be sent, in order that we might have as complete a census as possible of all persons able to carry on pathological work during the coming season. The response has been hearty and replies are still coming in. While it is not yet possible to make a definite statement as to the total number of available pathologists, it is already apparent that there will be a serious shortage of workers to carry out the important emergency work already planned by state and federal agencies. Every effort will be made to utilize all available men in the positions where they will be of greatest service, and lists of workers are being prepared for distribution, classifying those who have registered according to geographical location, special qualifications, length of time available for work, and in other ways.

Extension work for this season, in charge of Commissioner Whetzel, was considered at some length. The activities of the War Emergency Board in this direction must consist largely in efforts to stimulate a more concentrated and correlated attack upon certain important diseases through the established state and federal channels. It was agreed that the decision as to what extension campaigns should be pushed must be decided by the conferences of pathologists of the various sections. These are in most cases regional problems and can not be wisely decided by the board for the country as a whole.

The teaching of pathology during war times was discussed by Commissioner Whetzel. In view of the great and increasing shortage of pathological workers, all teachers of pathology should endeavor to giye their promising students special training. Particular emphasis should be laid on pathological courses in many educational institutions, and such courses should be introduced where they do not now exist. An increased supply of young pathological workers should thus be assured one year from now. Moreover, during the present semester special war emergency short courses open to all students without prerequisite should be instituted to give elementary training in plant pathology with a view to preparing the students for more effective work on the farms this coming season.

Commissioner Stakman outlined his work to date on the correlation of emergency research. Responses to his questionnaire on research problems were quite general and reasonably prompt. While it was the general opinion that much pathological research can not be called strictly war emergency work on account of the uncertainty as to time of obtaining results, yet there are many research problems of a distinctly emergency nature which can and should be pushed. The great work of the board in this field will be to coordinate research work and to secure voluntary cooperation in the solution of pressing problems by working through the established state and federal agencies. Such cooperative research on a broad scale has already been begun on the subject of seed treatment for cereal smuts and will be pushed to an early conclusion in order that present uncertainties as to

the best methods of treatment for different varieties and regions may be cleared up. There are other problems calling for nation-wide cooperative attack, but in general research problems are regional and can best be organized in the sectional conferences of pathologists where the different problems are acute. Commissioner Stakman will, from time to time, issue notices of cooperative research projects which are being taken up, giving the names of the leaders and an outline of the work. The War Board felt that this work of promoting cooperative research is one of the most important it can undertake, and that it has very far-reaching possibilities affecting American plant pathology.

Commissioner Lyman, in charge of crop loss estimates, reported on the collecting of data. Very gratifying response to his request for information on this difficult subject was received from pathologists throughout the country. A questionnaire sent to the county agents also yielded valuable data on certain important diseases. As a result a large body of data, probably more extensive than has ever before been collected, is now being classified and arranged. These figures will be resubmitted to the state and federal pathologists for thorough revision with a view to making them as authoritative as possible. They will then be issued in a special number of the *Plant Disease Bulletin* for general distribution. The board agreed that these crop loss estimates should be utilized as fully as possible in educational and publicity campaigns. The board also requested the Plant Disease Survey to collect such data as may be available from all sources on losses due to transportation and storage rots.

Commissioner Kern reported on plans for the conduct of a publicity campaign. It was agreed that it is very important that the general public be more thoroughly informed as to the significance of phytopathological work, including the losses due to diseases and storage rots, the significance to the public of these losses and their connection with high prices and food shortage. All possible agencies should be employed by pathologists generally to get this information to the public which is now interested in the subject on account of war conditions. Pathologists should publish articles in newspapers and popular magazines and should embrace every opportunity to deliver popular lectures on pathological subjects before miscellaneous organizations. Exhibits, displays and motion pictures should also be utilized.

The War Emergency Board adopted the following resolutions and it is hoped that all pathologists will assist in carrying them out and in translating them into action.

Whereas, the situation this year as regards extension work on the control of plant diseases presents many unusual and critical features, inasmuch as never before has there been such urgent need for control work in order that the food supply may be increased, while at the same time the general application of control measures will be rendered very difficult on account of the serious shortage of farm labor, making it almost impossible for the farmer to undertake any work not absolutely essential; whereas, on this account great care should be taken that the control work advocated is such as to bring tangible results, in order that the whole subject of plant disease control may not fall into disrepute among the growers.

Therefore, be it *Resolved* that principal emphasis this year should be placed on the serious diseases of the more important food crops for which control measures are thoroughly proven, and relatively easy and cheap of application; and

***Resolved* that all extension workers should be carefully instructed before going into the field as to the nature and scope of the work to be undertaken and the ways and means to be employed.**

Whereas, approximately 130,000,000 bushels of wheat and other cereals are lost annually on account of the attacks of preventable smuts, and, since this loss can be prevented easily at a cost not exceeding 3 cents per acre for materials and labor,

Therefore, be it *Resolved* that the War Emergency Board urge the enactment of legislation or the adoption of other methods for securing compulsory treatment of seed wheat, oats, barley and rye to eradicate preventable smuts and other diseases.

Whereas, extensive observations have shown that the common barberry (*Berberis vulgaris*) including its horticultural varieties, is an important link in the life history of stem rust of cereals in the upper Mississippi Valley, enabling it to develop and spread early in the season, thus conducing to serious epiphitotics; and whereas, the value of the common barberry in that region is

insignificant compared with the value of the cereal crops, especially since the immune Japanese variety (*Berberis thunbergii*) is displacing the common variety in popular favor,

Therefore, be it *Resolved*, that the War Emergency Board of American Plant Pathologists do hereby endorse and support the efforts to eradicate the common barberry in that region.

G. R. LYMAN,
Secretary

SCIENTIFIC EVENTS

THE YALE MEDICAL SCHOOL

PRESIDENT ARTHUR HADLEY, of Yale University, announced on February 22 to Yale men who had returned for alumni university day that the Yale Medical School, for the first time in the 104 years of its existence, possessed an endowment sufficient to insure its perpetuation and establish it in the fore rank of American medical schools.

Since June, 1914, as reported in the New York *Tribune*, the resources of the school of medicine have been increased by $2,568,812.55. This sum is exclusive of $266,075 donated for the exclusive use of the Yale Mobile Military Hospital in France.

The gifts to the school of medicine include $125,000 for the Anthony N. Brady Memorial Laboratory and an additional pledge of $500,000 for endowment from the Brady family, provided a total of $2,000,000 more was obtained.

Toward this $2,000,000 the General Education Board had promised the last $500,000. The Lauder family have given $400,000, the late Charles W. Harkness $100,000, and numerous other contributions had brought the total sum above the amount needed.

Five years ago it seemed probable that the Yale medical school would cease to exist. Despite the fact that it was then just ready to celebrate its centennial, its total endowment was less than $400,000, a sum insufficient to provide income to pay the salaries of professors.

The question of the continuance or discontinuance of the medical school was placed in the hands of men interested in Yale University. A committee consisting of the late Dr. Lewis A. Stimson, Dr. D. Bryson Delavan, Dr. William B. Coley, Dr. Joseph A. Blake and Dr. Walter James was asked to confer on ways and means with President Hadley, Dean Blumer, of the medical school, and three members of the Yale corporation.

The status of the school itself was first taken into consideration. In the face of many difficulties it had maintained so high a standard that it was ranked "Plus A," the highest class, by the American Medical Association. If the school was to continue, the conferees decided, first, it must maintain the same standards it had set. Most important, if this was to be done, was an affiliation with a hospital for teaching purposes. A second consideration insisted upon by the Yale corporation was that the mere question of pride on behalf of the university should not impel the continuance of the school. There must be a real need for it, recognized by the medical profession at large, or else it would be discontinued. This need was found to exist. The generosity of the family of Anthony N. Brady made the affiliation with the New Haven Hospital possible.

FARM PRODUCTS OF THE UNITED STATES

THE following statement pertaining to the crop achievements of 1917 and indicating what is possible in 1918 is authorized by Secretary of Agriculture Houston:

The production of food crops and of animal products is always a matter of great interest to all the people of the nation. At this particular time it is of especial interest and concern. Statistics regarding the acreages and yields of important food crops planted during the year 1917 have been available in the Department of Agriculture for some time and have been made public. The recent report of the Bureau of Crop Estimates on the number of live stock on farms and ranges, however, makes it possible now to exhibit a summary of the principal results of the farmers' operations for the year.

Naturally, when the nation entered the war on April 6, 1917, there was much confusion and apprehension as to the possibility of in-

creasing or even of maintaining agricultural production. There was special concern as to the sufficiency of the supply of labor that would be available for farming operations and much apprehension was manifested over the disturbance of the supply as the result of industrial demands and the drafting or volunteering of men for service in the army and navy. As a matter of fact, there was no little disturbance and in some sections the situation was especially acute. There were other difficulties confronting the farmers, including those of securing fertilizer and machinery in sufficient quantities at a reasonable cost.

Notwithstanding all the difficulties, however, the farmers, patriotically responding to the appeals to them and influenced by the prevailing prices, labored energetically to meet the needs of this nation for food and also those of the friendly nations in Europe. They planted the largest acreage in the history of the country, produced and harvested record crops of most products except wheat, and succeeded in increasing the number of live-stock, including not only work animals, but meat and milk animals.

The farmers of the nation planted during 1917, an acreage of 246,275,000 of the leading food crops (winter wheat, spring wheat, corn, oats, barley, rye, buckwheat, rice, Irish potatoes, and sweet potatoes), which was 23,038,000 acres (10 per cent.) greater than the acreage in 1916, and 32,339,000 (15 per cent.) greater than the average for the 5 years preceding the outbreak of the European War.

The farmers not only planted these acreages, but they harvested record crops of corn, oats, barley, buckwheat, and Irish and sweet potatoes. The total production of these products and of spring wheat and rice was 5,771,928,000 bushels, or 1,204,659,000 bushels (26 per cent.) more than in 1916, and 1,002,442,000 (21 per cent.) more than the average for the 5-year period (1910–1914). Winter wheat and rye are omitted from this comparison because the 1917 harvests of these crops were from sowings made in the fall of 1916, before the United States entered the war. It should be borne in mind in this connection that the percentage of soft corn this year was very much higher than usual, and also that the aggregate crop of spring and winter wheat harvested in 1917 was short.

During the first half of 1917 there was particular apprehension lest the number of live stock should be decreased. As a matter of fact, owing to the greater abundance of feedstuffs that the large crops of the year made available and the prevailing prices, there was revealed a most gratifying increase in the principal classes of live stock—an increase in the number of horses during the year of 353,000, or 1.7 per cent.; of mules, 101,000, or 2.1 per cent.; of milch cows, 390,000, or 1.7 per cent.; of other cattle, 1,857,000, or 4.5 per cent.; of sheep, 1,284,000, or 2.7 per cent., and of swine, 3,871,000, or 5.7 per cent.

The total estimated value of all farm products, including animals and animal products, for 1917 is given as $19,443,849,381, as against $13,406,364,011 for 1916, and $9,388,765,779 for the five-year average (1910–1914). These valuations are based upon prices received by producers, which are applied to the total output regardless of whether the products are consumed on the farms or sold.

PLAN OF WAR ORGANIZATION OF DIVISION OF MEDICINE AND RELATED SCIENCES OF THE NATIONAL RESEARCH COUNCIL

I. OFFICERS

Chairman, Richard M. Pearce (National Research Council) 1023 16th St., N. W., Washington, D. C.

Vice-chairman, Major Robert M. Yerkes, Surgeon General's Office, Washington, D. C.

Executive Committee: H. D. Dakin, 819 Madison Avenue, New York City; C. B. Davenport, Cold Spring Harbor, L. I., N. Y.; Major Simon Flexner, Rockefeller Institute, New York City; W. H. Howell, School of Hygiene, Johns Hopkins University, Baltimore, Md.; Major Chas. H. Mayo, Rochester, Minn.; Major Wm. J. Mayo, Surgeon General's Office, Washington, D. C.; Colonel F. F. Russell, U. S. Army, Washington, D. C.; E. R. Stitt, U. S. Navy, Washington, D. C.; Major V. C. Vaughan, Surgeon General's Office, Washington, D. C.; Wm. H. Welch, School of Hygiene, Johns Hopkins University, Baltimore, Md.; the *Chairman* and *Vice-chairman ex-officio.*

II. COMMITTEES INCLUDED IN MEDICAL DIVISION

1. *Anatomy Committee: Chairman,* H. H. Donaldson.

2. *Physiology Committee: Chairman,* W. B. Cannon. *Vice-chairman* and *Acting Chairman,* W. H. Howell.

(*a*) *Subcommittee for Investigations on the Physiology of Shock: Chairman,* W. B. Cannon.

(*b*) *Subcommittee on the Control of Hemorrhage: Chairman,* W. H. Howell.

(*c*) *Subcommittee on Solutions adopted for Transfusion after Hemorrhage: Chairman,* L. J. Henderson.

(*d*) *Subcommittee on Fatigue in Industrial Pursuits: Chairman,* Frederic S. Lee.

3. *Committee on Medicine and Hygiene: Chairman,* Victor C. Vaughan.

(*a*) *Subcommittee on Psychiatry: Chairman,* Stewart Paton.

4. *Psychology Committee: Chairman,* Robert M. Yerkes.

(*a*) *Subcommittee on Methods for the Psychological Examination of Recruits: Chairman,* Robert M. Yerkes.

(*b*) *Subcommittee on Tests of Special Skill: Chairman,* Edward L. Thorndike.

(*c*) *Subcommittee on Problems of Aviation, Including the Examination of Aviation Recruits: Chairman,* Edward L. Thorndike.

(*d*) *Subcommittee on Incapacity, Reeducation and Vocational Training: Chairman,* Shepherd I. Franz.

(*e*) *Subcommittee on Visual Problems: Chairman,* Raymond Dodge.

5. *Committee on Anthropology: Chairman,* Wm. H. Holmes; *Vice-chairman,* C. B. Davenport.

6. *Zoology Committee: Chairman,* E. G. Conklin.

(*a*) *Subcommittee on Medical Zoology, with groups representing* (*1*) *entomology,* (*2*) *helminthology,* (*3*) *protozoology.*

III. COOPERATING COMMITTEES (NOW EXISTING IN THE COUNCIL)

1. *Chemistry: Chairman,* M. T. Bogert.

(*a*) *Subcommittee on Biochemistry: Chairman,* Frank P. Underhill.

(*b*) *Subcommittee on Pharmaceutical Chemistry: Chairman,* Frederick B. Power.

2. *Food Committee: Chairman,* A. E. Taylor.

3. *Advisory Committee on Toxicity of Preserved Foods: Chairman,* J. J. Abel.

IV. PURPOSE

To concentrate in Washington a comparatively small body of men representing the existing committees, and thus provide for effective cooperation in the rapid organization of medical research as an aid to the solution of urgent military problems.

V. FIELD

Medicine, surgery, hygiene, physiology, anatomy, psychology, psychiatry, physical anthropology and closely related subjects.

VI. METHODS

1. To cooperate closely with the Surgeon General of the Army (through Colonel Russell) and of the Navy (through Dr. Stitt) in determining urgent problems and to enlist the aid of civilian laboratories in the solution of these problems.

2. To assist the Surgeons General of the Army and Navy in procuring trained investigators to enter the respective services as contract surgeons to undertake special field investigations during short periods of time.

3. To send, if it is considered advisable, individuals to England, France and Italy to determine the urgent problems which should be taken up without loss of time in civilian laboratories in this country.

4. To invite, if it is considered necessary, commissions or individuals from England, France and Italy to this country to advise with the Medical Division of the National Research Council.

5. To maintain correspondence with prominent medical investigators in the American Expeditionary Forces and in civilian laboratories in France, England and Italy and thus obtain reports of the important fields of research, the character of the work in progress and the needs of the workers.

6. To establish relations with and if agreeable to them, to cooperate with research organizations abroad as (*a*) British Medical Research Committee, (*b*) the Research Society recently organized in France by medical officers of American, French and British forces, and (*c*) the Committee on Medical Research of the American Red Cross in France, etc.

7. To obtain reports of all medical research organizations in this country dealing with war

problems and of individuals engaged in the investigation of war problems.

8. To maintain a bureau for the dissemination of up-to-date bibliographies of all forms of medical research bearing on war problems.

9. (*a*) Prepare lists of individuals and laboratories equipped and ready to undertake research at short notice.

(*b*) Prepare lists of individuals who will hold themselves in readiness to move from laboratory to laboratory to work for shorter or longer periods on special or emergency problems or to augment existing laboratory staffs in a group of selected laboratories.

10. To hold conferences from time to time in Washington or other central city for discussion of important research problems and methods of attack.

11. To hold military medical meetings from time to time, in the neighborhood of large cantonments for the discussion of medical problems by military and civilian physicians.

SCIENTIFIC NOTES AND NEWS

Dr. Allan J. McLaughlin, health commissioner of Massachusetts, has been recalled to Washington by federal authorities. He will become assistant surgeon-general in the public health service of the United States. As second in command he will have control of all the domestic health work, particularly with respect to the military cantonment areas.

Major Frank Billings, professor of medicine in the University of Chicago, who was appointed medical adviser to the governor of Illinois, in the creation of the medical advisory boards, has been assigned to the Provost Marshal General's office in Washington. Major Billings' work is understood to be that of adviser to the Provost Marshal in connection with the medical problems under the Selective Service Law.

Dr. Douglas W. Johnson, associate professor of physiography in Columbia University, has recently been commissioned major in the Intelligence Section of the National Army, and expects to leave for Europe on a special mission for the government.

Professor William B. Herms, associate professor of parasitology and acting head of the department of entomology, University of California, has been appointed captain in the Sanitary Corps, National Army, and has been ordered to Fort Sam Houston, Texas, for duty. Captain Herms was actively engaged during the past summer and autumn in investigating the sanitation of military camps in the western department, particularly as regards mosquitoes and flies.

Dr. Paul H. M.-P. Brinton, professor of analytical chemistry in the University of Arizona, has been commissioned captain in the Ordnance Reserve.

Albert T. Poffenberger, Ph.D., instructor in psychology in Columbia University, has been commissioned a captain in the Sanitary Corps of the National Army and will be assigned to the psychological examination of recruits.

Dr. Dennie H. Udall, professor of medicine and superintendent of the ambulatory clinic of the New York State Veterinary College, has been made a major in the Veterinary Corps of the National Army and has asked for a leave of absence for the duration of the war. Dr. W. E. Muldoon, assistant professor of materia medica of the same institution, has also been commissioned and has asked for a leave of absence.

Captain Walter L. Conwell, of Cornell University, until last June assistant professor of railroad engineering in the college of civil engineering, has been promoted to Major of the 307th Field Artillery, at Camp Dix.

A. P. Mills, assistant professor of materials in the college of civil engineering, Cornell University, received his commission as captain in the Engineer O.R.C., and is awaiting orders.

Pope Yeatman, consulting engineer of New York, has been placed in charge of the nonferrous metals department of the War Industries Board, in succession to Eugene Meyer, Jr.

At the recent meeting of the American Association of Anatomists, held in the new Institute of Anatomy at the University of

Minnesota, Professor Robert R. Bensley, of the department of anatomy at the University of Chicago, was elected president of the association.

THE Nashville Natural Science Society was organized in the early autumn of 1917 by persons professionally engaged in natural science work, not including physics and chemistry. Its purpose is the advancement of science in Tennessee, and especially, in the vicinity of Nashville. The following officers were elected for the academic year 1917–18: *President,* Dr. R. M. Strong, Vanderbilt University Medical school; *Vice-president,* Dr. Edward E. Reinke, Vanderbilt University; *Secretary-treasurer,* Mr. J. M. Shaver, Peabody College; *Members of Executive Council,* Dr. A. E. Parkins, Peabody College, Dr. George M. Curtis, Vanderbilt Medical School, Mr. L. V. Silvester, Vanderbilt University.

DR. HENRI M. AMI, Canadian geologist and paleontologist, has been elected vice-president of the Geological Society of France for the year 1918, at its last meeting held in Paris. Emmanuel de Margerie, secretary of the society, in communicating the information states that the Geological Society of France desires by this choice, not only to express the esteem in which Dr. Ami himself and his work in geology are held, but also the full gratitude and the admiration of the people of France for his generous country. He adds:—"Vive le Canada! whose sons are fighting so gloriously for the defence of the Liberty of the World."

NICHOLAS KOZELOFF, Ph.D. (Rutgers, 1917), has been appointed bacteriologist of the Louisiana Sugar Station, to succeed W. L. Owen.

DR. GEORGE E. HALE, director of the Mt. Wilson Solar Observatory of the Carnegie Institution of Washington, and chairman of the National Research Council, gave the second lecture in the series on science in relation to the war before the Washington Academy of Science on February 21. The subject of the lecture was "Astronomy and war."

AUTHORITIES possessing an intimate knowledge of the chemical and allied industries of China will deliver illustrated talks at a joint meeting of the New York Sections of the American Electrochemical Society, Society of Chemical Industry and American Chemical Society, on March 1. The meeting will be held in Rumford Hall, Chemists' Club. One of the speakers will be H. K. Richardson, who will speak on "A chemist's view of the native industries of China."

DR. EDMUND ARTHUR ENGLER, for twenty years professor of mathematics at Washington University, St. Louis, and for ten years president of the Worcester Polytechnic Institute, and president of the Academy of Science of St. Louis at the time of his death, died after a brief illness on January 16, aged sixty-one years.

DR. CLARK BELL, long president of the Medico-Legal Society, New York, died on February 22, at the age of eighty-five years.

PROFESSOR LEVI M. UMBACH, professor of biology at North-Western College since 1884, died on January 27. Mr. Umbach was born in Ontario on July 15, 1853, graduated from North-Western College in 1877, and since 1884 has been teaching continuously in North-Western College with the exception of one year. Since 1888 he has held the chair of biology in the college. Professor Umbach's chief interest lay in botany, especially systematic botany. He was chiefly instrumental in gathering the herbarium of North-Western College, containing some 40,000 specimens. He was especially well acquainted with the flora of the central west, Ontario, and of the northwest, and discovered a large number of new species of plants, one of which bears his name, "Fontinalis Umbachii Cardot."

A WAR RESEARCH BOARD to centralize all government work now being done at Cornell University has been organized by the board of trustees, and President Jacob Gould Schurman has been requested to name three members of the university faculty. This board will have full charge of all work which the government wishes Cornell to do.

At the meeting of the board of regents of the University of Minnesota on January 18, a proposal by E. C. Kendall and Drs. W. L. and Charles H. Mayo to grant and convey to the University of Minnesota certain rights under letters patent of a discovery by Dr. Kendall of an agent for the treatment of diseases, which has been by him designated "Thyroxin," was submitted, and it was voted to appoint the president, the dean of the department of medicine and Dr. Rowntree a committee to consider the proposed agreement and report to the board.

UNIVERSITY AND EDUCATIONAL NEWS

By the will of General Horace W. Carpentier, a trustee of Columbia University, who died on January 21, at the age of ninety-two years, his residuary estate is divided between Columbia University and Barnard College, providing, it is said, over a million dollars for each institution. Bequests are also made to Columbia University of about $100,000 for the Dean Lung department of Chinese and about $200,000 to the medical school. Barnard College receives $200,000 for scholarships, and $100,000 is bequeathed to the University of California. There are also bequests to hospitals and for other public purposes.

Following the monthly meeting of the Yale corporation it was announced that Professor Russell H. Chittenden had been reappointed director of the Sheffield Scientific School for a term of five years, as requested by the governing board.

Professor William A. Riley, since 1912 professor of insect morphology and parasitology in the college of agriculture of Cornell University, has been elected professor of parasitology and chief of the division of economic zoology in the University of Minnesota, and will take up his duties there at the beginning of the next academic year.

Dr. John H. Hamilton, of Albany, N. Y., has been called to the State University of Iowa to succeed Dr. M. F. Boyd, as professor of preventive medicine and state epidemiologist.

Mr. Thomas J. McCarter, M.A. (Texas, 1916), has been appointed professor of physics in North-Western College, vice Mr. C. C. Van Voorhis, resigned. Mr. McCarter formerly held a position in the faculty in the University of Texas and more recently with the Bureau of Standards at Washington, D. C.

Fred G. Allen, of Erie, Pa., a graduate of the University of Toronto, has been appointed assistant professor of electrical engineering at Lafayette College to take the place left vacant by the resignation of E. D. Tanzer, who has become assistant professor of electrical engineering at the Georgia Institute of Technology.

Dr. John T. Black, commissioner of health of the State of Connecticut, and Dr. Walter H. Brown, health officer of Bridgeport, have been appointed lecturers on public health at Yale University for the next year.

DISCUSSION AND CORRESPONDENCE

DIMINUTION OF THE ANTARCTIC ICE CAP AND THE AMELIORATION OF CLIMATE

In a recent number of Science, Marsden Manson[1] has directed attention to the highly important scientific results of the Antarctic expeditions under Captain Scott and Sir Ernest Shackleton, and has succinctly stated several broad generalizations based upon the data thus obtained. From the majority of these conclusions few glacialists would dissent, but exception must be taken to the main theme that the present diminution of the Antarctic ice cap proves the climate of the world to be undergoing a rise in temperature which will enable the "moss of polar wastes" to "be replaced by rye and wheat."

The position of the margin of ice sheet or valley glacier is a compromise between two factors: the forward or outward motion of the ice, and depletion resulting from melting or from wave action. The ice front advances when the former exceeds the later; it retreats when the relations are reversed. Variations in the rate of movement of the ice depend upon changes in temperature and in supply of new ice formed from snow. A dry glacier is a

[1] "The Bearing of the Facts Revealed by Antarctic Research upon the Problems of the Ice Age," Science, N. S., Vol. 46, pp. 639, 640, December 28, 1917.

slow-moving glacier, and a glacier is dry when it is cold. Likewise a wet glacier moves rapidly, and a wet glacier is comparatively warm. It may well happen that a slight rise in temperature would cause a forward movement of the ice edge and a slight fall in temperature a regressive movement. Again, heavy snowfall results in rapid accumulation of ice and is followed by an acceleration in the forward or outward push of the ice mass, while a lessened precipitation must result in slower movement and decrease in volume. Possibly, the present retreat of the Antarctic ice is due to a progressive desiccation of Antarctic climate. Temperature is by no means the only, nor necessarily the determining, factor.

At the same time, it is doubtless true that the climate of the globe is now warmer than it was during the episodes of extensive glaciation characterizing the Pleistocene Ice Age, which by the way, was equalled in the magnitude of its ice sheets by at least one earlier glacial period, that of late Paleozoic time. Moreover, from the geological point of view the present world-climate, with its polar refrigeration and marked climatic zones, is abnormal; the earth has offered a much more congenial environment than this throughout the greater part of its recorded history. But the data are not now sufficient to point clearly toward a swift and steady replacement of the present semi-glacial temperatures by those of normal and more hospitable range.

Placing the present moment in earth history in its true perspective with relation to the preceding geologic incidents, several alternatives arise concerning what will be disclosed on the geologic morrow. During Quaternary time oscillations in climate are recorded by at least four episodes of glaciation separated by intervals of partial or complete deglaciation. The last great swing of the climatic pendulum reached its farthest limit in the direction of refrigeration about thirty thousand years ago. It is possible that the return oscillation will carry the weather conditions back to those of the normal, ice-free, geologic period, and Quaternary glaciation will be a thing of the past. On the other hand, it is just as likely that the backward rush of the pendulum is now retarding and that soon it will be poised for another sweep in the opposite direction to bury middle latitudes beneath the weight of ice sheets of a new glacial stage. In that case we are to-day not in a post-glacial but an inter-glacial time such as that enjoyed by the men of Neanderthal, when osage oranges and paw paws flourished north of Lake Ontario and figs grew in the Kootenay Valley.

It is unfortunate that no certain selection may be made from these alternatives of the one which is imminent, for the question is one of more than academic interest. Legislation which is forward-looking, far-reaching plans for racial progress, promotion of economic welfare, all must be radically influenced by the knowledge—if we had it—that in ten thousand years the Barren Lands of the north could support a population of fifty to the square mile, or that in a similar interval the available farm lands of the globe will be reduced to half their present area.

The key which will unlock the mystery of the major climatic trend of the present time is not to be found in observations upon the terminal position of ice sheet or glacier, unless those observations are extended over centuries. It is rather to be sought in the determination of the influence which the combustion of coal in this industrial age is exerting upon the carbonic-acid content of the air, and of the headway which the warm (though unusually salt and therefore heavy) water of the Mediterranean Sea is making as it creeps outward through the Straits of Gibraltar down the sloping floor of the Atlantic ocean and spreads poleward beneath the cold but fresher water of the deep sea.

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LABELING OF MICROSCOPICAL SLIDES IN STAINING TECHNIQUE

THERE seems to be distinct need of a satisfactory method of temporarily labeling microscopical slides destined for the staining, wash-

ing, dehydrating and clearing processes in ordinary microtechnique, especially when objects and stages of diverse nature are to be passed through in large numbers at a time. Higgins's waterproof ink and preparations involving sodium silicate either wash off, or, if they survive to the end, rub off when dry in spite of even the most careful handling. West, in a recent number of SCIENCE,[1] suggests the use of numbered aluminum clips and a notebook. This method would appear to be clumsy and wasteful of time and imperfectly adapted to slides of varying thickness, besides necessitating permanent labeling of the slides as soon as the small supply of clips becomes exhausted. To meet these objections, an ink has been devised which apparently answers all ordinary requirements of the investigator. It has been used in the making of hundreds of slides, and one supply made two years ago is still giving great satisfaction.

The method of making the ink may be stated briefly as follows: 15 g. of best cabinetmakers' glue are dissolved at low temperature in 100 c.c. of water in a clear glass bottle. To this is added an excess of crystals of potassium dichromate and the mixture is exposed for a week or more to strong light, after which it is filtered. India ink is rubbed into this "stock solution," a slate ink cup or grinder being employed. A little of the solution is poured into the cup and a stick of India ink is applied, the rubbing being done with a circular motion. When sufficient blackness is obtained, the ink is removed with a dropper to a small bottle; the operation is repeated with a new supply of stock solution until a sufficient quantity of ink is accumulated. A supply sufficient for several years' use can be made in this way in the course of an hour or two.

The ink will keep indefinitely if care is taken to prevent evaporation. It may best be kept in a small narrow-neck balsam bottle with ground joint, the joint being further sealed with a thin coating of vaseline. The label end of the slide should be clean and free from fixative, when the ink will flow freely. An ordinary clean, medium-pointed steel pen may be used. A dozen slides may be labeled with accession number, thickness of ribbon and other data with a single dipping of the pen. The ink will dry thoroughly in a few minutes at ordinary room temperature, after which the slides may be passed through the alcohols, stains, water and xylol without deterioration of the label. On completion of the slides the label may be left as originally made and the slides stored in this condition until they are wanted. This will be found sufficient for most research problems. If it is desired at any time to replace the original label with a permanent one, the ink may be quickly scraped off with a scalpel and replaced by a pasted label. In doing this the figure or letter usually comes off entire with a slight lifting movement of the knife.

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[1] N. S., Vol. XLVII., No. 1201, January 4, 1918, p. 22.

PROFESSIONAL COURTESY

IN the January, 1918, number of the *Journal of Biological Chemistry* appeared an article by E. V. McCollum and N. Simmonds, now of Johns Hopkins University, entitled "A Study of the Dietary Essential, Water-Soluble B, in Relation to Its Solubility and Stability Towards Reagents."

This work, as the article indicates, was done, but not prepared for publication, in the laboratory of agricultural chemistry of the University of Wisconsin. The authorship of this article does not properly give credit to those participating in this research. On page 62 a footnote briefly states that "Credit is due Mr. H. Steenbock for the preparation of the extracts employed in this work." This representation is a gross injustice to Professor Steenbock and displays a marked transgression of common professional courtesy and ethical standards on the part of the authors of this article. Professor Steenbock not only contributed much, if not all, to the thought expressed in the preamble of this article, but the details of making the vitamine preparations and the

chemical work in reference to their stability reappear in the text practically verbatim as they were developed by him in his own notebooks. The method of experimentation on vitamine stability as published in this paper was the outgrowth of methods previously employed by Professor Steenbock in experiments with pigeons. He should at least have appeared as a joint author of this article.

Inasmuch as the records of rat feeding, although they were part of a continuing project of the experiment station, were removed in toto from the campus with the change in staff and consequently no longer available, it had not been possible for Professor Steenbock to correlate this material for publication.

E. B. HART
Chairman of the Department of Agricultural Chemistry, University of Wisconsin

SCIENTIFIC BOOKS

Outlines of Comparative Anatomy of Vertebrates. By J. S. KINGSLEY, Professor of Zoology in the University of Illinois. Philadelphia, P. Blakiston's Sons & Co. Second Edition, Revised. 1917. Pp. 449.

A well-known teacher of comparative anatomy has characterized Professor Kingsley's "Outlines of Comparative Anatomy of Vertebrates" as "the best text-book of comparative anatomy in the English language." The rapid exhaustion of the first edition and the appearance of the second suggests that many other teachers share his opinion. The second edition is enlarged by the addition of fifty pages of reading matter and contains sixty more text-figures than the first edition, while the fundamental plan of the book remains unchanged. A list of Greek and Latin roots has been added to help the student to understand the meanings of the anatomical and embryological terms used.

From extended experience as a teacher of comparative anatomy Professor Kingsley has learned that a plain diet of anatomy is unacceptable to the average college undergraduate. "Boning" and "grinding" are college synonyms and the undergraduate does neither gladly. Anatomy therefore in the Kingsley text is made more palatable by the addition of enough physiology to give it flavor—and "meaning" in terms of function. Furthermore, an embryological approach to the study of each organ system is calculated to give a clearer conception of the fundamental relationships of the system within the organism as a whole. The text is well written with these pedagogical ends in view.

College students, however, are interested in comparative anatomy chiefly because of the bearing of the facts upon the theory of evolution in general and upon the history of the human body in particular. The text fails in general to utilize this interest. Were the bearing of the evidence upon the important problem of human phylogenesis more frequently pointed out and were much material devoid of such human interest omitted, the text would undoubtedly lose somewhat as a reference book in comparative anatomy, but it would make a much stronger appeal to undergraduates.

In its lucid and accurate descriptions and careful classification of materials the book serves as an admirable example of the scientific method. Its generalizations and interpretations, moreover, are cautious and based upon exceptional familiarity with animal structure and acquaintance with the extensive literature of comparative anatomy and embryology. The spirit of the book is open-minded and undogmatic. Errors of statement in the second edition are relative few. The statement (p. 132) that "the somatic wall of the myotome does not participate in muscle formation" needs qualification, since it is not true of all vertebrates. The retractor bulbi muscle (p. 134) is a derivative of the third and not of the first head cavity (Johnson, '13; Miss Fraser, '14). The electric organ of *Astroscopus* (p. 142) comes from the superior oblique muscle as well as from the muscles innervated by the oculomotorius. The "limiting sulcus" (sulcus of Monro) is not a characteristic feature of vertebrate embryos in general, as might be inferred from the descrip-

tion on page 148. It should not be forgotten that the nervous character of the so-called thalamic nerve (mentioned on p. 184) has never been demonstrated, nor is it so certain that "the eye grows out from the dorsal zone of the forebrain" since that depends upon what is taken to be the morphological anterior end of the brain.

Is the conclusion (p. 191) justified that "since the vagus is a cranial nerve, its distribution to heart, stomach and lungs, shows that these structures belong to the head"? Possibly they do, but by the same token so does the tail belong to the head since this also is innervated by a branch (N. lateralis) of the vagus. In the light of what we now know regarding nerve histogenesis is it not time that the dogma of a primary, unalterable connection between nerve and its terminal organ were abandoned? Fats are spoken of (p. 220) as "hydrocarbons," although the term is used by organic chemists only in reference to oxygen-free carbon compounds. Considering the scope of the book, however, such exceptional errors are not surprising. In a field where the possibilities of divergent opinion are so many it is remarkable that the book contains so few statements to which exception may be taken.

Numerous illustrations, mostly from original sources, constitute one of the most distinctive features of the book. The unusual skill of the author as an artist is shown especially in the admirable stereograms scattered through the book, which in this respect makes another real contribution to the pedagogy of comparative anatomy. The outline drawings, however, are not always easily analyzed by the eye and might be improved by more contrast. The addition of a diagram to illustrate some of the more important fiber tracts of the vertebrate (Mammalian?) brain would aid the description on page 153. A few errors of labelling persist in the second edition. The numbers of the first and second head cavities are interchanged in Fig. 270. In Fig. 336 the right and left post-cardinals are incorrectly labelled as "post-cavæ." In Fig. 378 the two oviducts are shown as uniting in a "urinary bladder." Some typographical errors there are of course. The book as a whole however, is one in which American morphologists may take just pride as an admirable piece of work by an American zoologist of distinction aided by an American publisher of high ideals of typographic workmanship.

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A Year of Costa Rican Natural History. By Amelia S. Calvert and Philip P. Calvert.

The chief object in the visit of these two entomologists to Costa Rica was a study of the dragonflies with special reference to their life-histories and seasonal distribution. However, in the preface, we are told: "Our investigations have not yet been completed and we have little to say in these pages on that technical subject. What we here set forth are chiefly our more incidental observations recorded in our diary." The first point made by the authors is in regard to the changes which will be induced by the Panama Canal. We are given no hint of the factors productive of such changes or of their nature or extent. But in view of the expectations of such transformations, it is a pity that a delay of about eight years has intervened between the expedition and this publication of the general résumé of its results.

The authors have shown wisdom in rewriting their notes and doing away with any diary form. They have grouped their observations geographically and when several separate visits were made to any one place, these are grouped in a single chapter. As the five hundred pages of text deal chiefly with disconnected, casual notes, with annotated facts and identifications, it is impossible to offer anything like a detailed criticism. The excellent index places this information in a form readily available for reference. The volume is filled with interesting matter and adumbrates what must be the all-important scientific work of the future—the direct correlation of field work with that of the laboratory and museum. As we might expect, the chief interest was insects, although plants form a close second in

amount of space. In the case of the latter, many photographs aid in familiarizing the reader with the forms of flowers and foliage. Notes on mammals and birds are almost absent. A single instance of a bird feeding upon lepidoptera was noticed. On the other hand, copious notes were made on the natives, their customs, mode of life, houses and villages. But the matter relating to dragonflies, the discovery of the various forms and the rearing of their larvæ, stand out from all the rest of the text. In dealing with this phase of research, the enthusiasm is distinctly greater, the diction more pleasing, and the treatment more thorough.

The text presents many readable descriptions of scenery and of unexpected conditions in this tropical country. Such a one is the strawberry field with its amazing amount of delicious fruit, shaded by tall rose trees. And the last chapter has a most vivid narrative of a disastrous earthquake in which the whole city of Cartago was ruined and several hundred people killed. The authors fortunately escaped with their notes and photographs. They go on to recount: "The falling wall carried with it the tumbler shelf so that the larvæ, the rearings of many months, were all killed—with one extraordinary exception. A bottle of new *Cora* larvæ which P. brought with him the evening before from Juan Vinas —the rarest thing we had—was found on the floor, unbroken and with the larvæ alive!"

In addition to the well-made index there are several appendices dealing with the itinerary, temperature and rainfall records, a summary of papers published in connection with the collections made on the trip, and a systematic list of plants and animals mentioned. As this latter has the page references, the contents of the volume are thus made still more available for reference. The authors are to be sincerely congratulated on having saved their incidental notes and observations from oblivion. Such work can not fail to add to any breadth of generalizations in their own more narrow field of special, intensive work, and sets a standard for other expeditions which it is hoped will often be equalled or surpassed. "The Voyage of the Beagle" is bearing late fruit and should be a stimulus to all such effort in the future.

WM. BEEBE

NEW YORK ZOOLOGICAL PARK

SPECIAL ARTICLES

THE EFFECT OF OMNIVOROUS AND VEGETARIAN DIETS ON REPRODUCTION IN THE ALBINO RAT

AN experiment, now in its fifth year, is being carried on to show the effect of a vegetarian diet as compared to an omnivorous diet on reproduction in the albino rat in regard to:

1. The relative number of litters produced.
2. The relative number in the litter.
3. The relative frequency of producing litters.
4. The relative ratio of the sexes.
5. The relative vitality and growth of the young.
6. The relative longevity and general appearance.
7. The relative age at which breeding begins and ceases.
8. The general effect upon successive generations.
9. Sterility test; to determine whether it is the male or the female which is rendered impotent.

The number of pairs constantly under observation was 40. Approximately 20 of these pairs were restricted to a vegetarian diet and the remaining, used for control, were given the same vegetables with some form of animal food added. As soon as one of a pair died the other was remated. Or when they became too old to breed they were discarded and the cage restocked.

The results and conclusions so far reached may be summarized as follows:

If only those pairs which produce litters are taken into consideration the average number of litters per pair for the omnivorous group is 3.73 and for the vegetarian, 1.93. But when the whole group of matings are considered we find that 11.5 per cent. of the omnivorous and 55.9 per cent of the vegetarian pairs failed to reproduce. If these are considered, the average number of litters is

reduced to 3.15 and .89 per pair respectively. This is a ratio of about 3.6 to 1 in favor of the omnivorous feeders.

The greatest number of young born by a single pair is 41 in the omnivorous group and 23 in the vegetarian group. The average number of young for each mating is 15 for the omnivorous feeders and 4 for the vegetarian.

The number of young eaten by the parents is 19.5 per cent. in the omnivorous group and 35.8 per cent. in the vegetarian.

The ratio of sexes in the two groups is 113.6 males to 100 females in the omnivorous young and 107.6 males to 100 females in the vegetarian young.

The average weight (both sexes) of the omnivorous young at birth is 4.59 grams and the vegetarian young is 4 grams. A much heavier weight is maintained by both sexes of the omnivorous rats throughout their lives as shown in the curves of growth. This is shown in the following table. The retardation of growth of the new born vegetarians appears to be due to the decreased lactation of the mothers.

	Avg. No. Litters per Breeding Pairs	Percentage of Non-breeding Pairs	Total Avg. No. Litters	Greatest No. Litters	Greatest No. Born from Single Pair	Avg. No. Born per Pair	Avg. No. in Litters	Avg. Wt. in Grams at Birth	Avg. Wt. in Grams at 30 Days	Avg. Wt. in Grams at 600 Days	Ratio of Sexes of Young	Percentage of Young Eaten by Parents	Youngest Age in Days of Mother at 1st Litter	Avg. Age in Days of Mother at 1st Litter	Oldest Age in Days of Mother at Last Litter	Avg. Age in Days of Mother at Last Litter	Avg. Interval in Days Between Litters
Omnivorous.....	3.7	12%	3.15	9	41	15	4.8	4.59	28.8	208	113♂ to 100♀	19.5%	90	169	570	330	67
Vegetarian	1.9	56%	.89	3	23	4	4.5	4.00	15.7	140	107♂ to 100♀	35.8%	119	223	600	334	97

The difference in appearance of the two groups is very marked. The vegetarians are smaller, have less vigor, are less active, have rougher hair and a tendency to sore eyes, while the omnivorous are the reverse in these respects.

The earliest ages at which the first litter was thrown is 90 days for the omnivorous and 119 days for the vegetarian group. Since the period of gestation is 21 days the age of sexual maturity in each of these cases was 59 and 98 days respectively.

The average age at which the first litter was born was 169 days for the omnivorous and 223 days for the vegetarian rats.

The oldest age at which a litter was born in the omnivorous group was 570 days and in the vegetarian, 600 days. The average ages were 330 and 334 days respectively. The average duration of the period of reproductive activity in the omnivorous group is thus 161 days and in the vegetarian group 111 days. The restricted diet thus appears not only to delay the period of reproductive activity, as other writers have found, but also to actually shorten the duration of this period.

Matings were made to test which sex was the cause of the failure to reproduce. Vegetarian pairs, when they ceased to reproduce, were separated. New healthy omnivorous males were mated to the vegetarian females and new healthy omnivorous females were mated to the vegetarian males. All these new matings failed to reproduce. The conclusion drawn is that a vegetarian diet produces sterility in both sexes.

It has been impossible to determine the effect of a continued vegetarian diet on the race, as only two or three successive generations have been reared on this diet before the line of descent became extinct. We must therefore conclude that a vegetarian diet not only reduces the vitality, the growth, and the ability to reproduce, but tends to the extermination of the race.

We are expecting to have the complete paper ready for publication in the near future.

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